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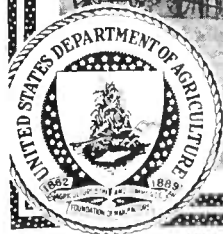
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SAVING LIVESTOCK FROM STARVATION ON SOUTHWESTERN RANGES



CATTLE AND SHEEP on Southwestern ranges are subject to severe losses from starvation during forage shortage caused by the ever-recurring droughts. To be prepared for these conditions by the establishment of range methods which anticipate them is essential.

Proper stocking, reserving part of the range for the critical period in every year, providing adequate water, close culling and other adjustments in the herd, supplemental feeding, and the giving of proper care and attention are practices which should be followed. These measures may cause a decrease in the herd and an increase in the cost per head, but the final results will be profitable because of fewer losses, a higher percentage of calves and lambs, increased quality and enhanced value of the animals, and better financial credit. The livestock industry will thus be placed on a more stable and a more profitable basis.

The practices herein recommended are based upon study and experience and should prove helpful to those engaged in livestock production in the Southwest.

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SAVING LIVESTOCK FROM STARVATION ON SOUTHWESTERN RANGES

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EFFECT OF ERRATIC RAINFALL ON LIVESTOCK PRODUCTION

THE SOUTHWEST, including western Texas, New Mexico, Arizona, parts of southern California and southern Nevada, constitutes one of the important cattle and sheep producing sections of the United States. Because of the low rainfall the region is not well suited, without irrigation, to the raising of farm crops, but much of the land produces excellent native pasturage. The climate in general is so mild that livestock require no protection from winter weather, and it is the usual practice to graze them on the range throughout the year. The cost of production is therefore normally lower than in the sections where long winter feeding is necessary.

The region would be almost ideal for livestock raising were it not for the insufficiency of forage in times of drought. With livestock production principally on a yearlong range basis, when there is a shortage of range feed the number of animals lost is sometimes appalling. The so-called die-offs are often 25 to 50 per cent of all the cattle and include many sheep. Adverse climatic conditions have not infrequently necessitated the moving of thousands of livestock to regions where feed and water were available in order to avoid a total loss. As losses occur largely in the breeding herds and affect the producing end of the industry, several years are usually required for recovery from the setbacks.

REDUCTION IN CALF AND LAMB CROPS FOLLOWS FORAGE SHORTAGE

Because of open winters the Southwest is suited for the production of young stock; lack of proper forage, however, for bringing them to maturity necessitates their early disposal, and the livestock industry should be upon that basis. Maximum crops of calves and lambs

are of prime importance, and these crops are both heavily reduced by adverse conditions. As the death rate is greatest among cows heavy with calf and among ewes about to lamb, the loss of a cow or ewe usually means also the loss of a calf or a lamb. When range conditions are bad, poor cows or poor ewes are often not able to provide adequate nourishment for their young, and the mortality rate in offspring is unusually high after calving or lambing. Frequently cows with young calves are in such a poor condition in the spring and summer that they do not breed, and consequently calve only every other year. The low average annual calf crop in the Southwest is largely a result of this situation.

SERIOUS LOSSES RESULT FROM POOR CONDITION OF LIVESTOCK

Young animals are stunted by these unfavorable range conditions, and this further reduces the income from the livestock business. Calves or lambs that are undernourished the first few months of their lives do not make average weight at time of weaning or of sale. Cattle less than 4 years of age are commonly very much under the average weight of their respective age classes farther north, resulting in lower prices being paid and in heavy "cut backs" being made by purchasers.

The poor or emaciated condition of livestock frequently contributes to losses from other causes. Ordinarily the number of calves killed by coyotes on the range is small, but these losses increase when the mother cows are too weak to protect their young. The mortality from poisonous plants is invariably heaviest when livestock are hungry or when the range is closely grazed. Many poisonous species are among the earliest plants to make their appearance in the spring; and, if the supply of feed is short, livestock are attracted to them more than they otherwise would be.

Animals in a weakened condition are naturally less resistant to many diseases and to the infestation of such pests as lice and ear ticks. Outbreaks of scabies are usually more severe when stock are poor. Dipping or other treatment is an added expense, and losses result from the additional handling that becomes necessary. Many weak cows are lost in boggy places about springs and watering places and along streams where cattle drink.

Success and stability in the range-livestock business depend largely upon what can be done to minimize these losses. Any solution of the difficulties must deal primarily with the problem of providing more range forage, sufficient supplemental feed, and an adequate supply of water to meet the needs of the animals carried through the critical periods. As livestock in this region are dependent mainly upon range forage during the entire year, a more conservative range use is of first importance. Other measures, however, like the providing of supplemental feed and the better handling of the livestock will help to improve conditions (fig. 1).

OCCURRENCE OF DROUGHT AND EFFECT ON CARRYING CAPACITY

Droughts of 3 or 4 years duration may occur in the Southwest in each cycle of approximately 8 to 10 years. In addition, droughts of less severity frequently occur at irregular inter-

vals within these cycles. During these times the forage on the range may be materially reduced below that produced in average years. The amount of this variation will depend upon the locality and the duration of the drought. On the lower semidesert ranges the supply may be 50 per cent or less of the carrying capacity in average years. From that extreme it varies from 10 to 25 per cent reduction in the higher ranges, where the annual precipitation has less fluctuation. If, at the time of one of these droughts, the ranges are stocked on the basis of a full use of the forage available in an average year, the losses are liable to be extremely heavy.

Besides these frequent extended droughts, there may be a critical period in any year when the dry forage is low in nutritive value or when spring rains are scanty or lacking. This period extends from March until the summer rainy season, usually about the middle of July. Livestock are then in their poorest condition, and unless



FIG. 1.—Grade Hereford cattle on the range in the Southwest. More conservative stocking of the range, more liberal use of supplemental feeds, adequate water, and better care are essential to the welfare of the stock industry in the Southwest. Otherwise valuable breeding herds will sustain heavy losses or be entirely sacrificed in time of drought.

measures are taken to meet this situation there are usually some losses.

Rodents, especially prairie dogs, do considerable damage and materially reduce the carrying capacity of many southwestern ranges. This effect is most serious in periods of drought when every blade of grass is needed by livestock. Systematic campaigns for their extermination have proven effective in their control.

DANGERS OF OVERSTOCKING

Any practice that results in the presence of more livestock on the range than the available forage crop will support is precarious. If there is dependence upon range throughout the year it is obvious that overstocking will result in a shortage of range feed toward the end of the grazing year, with consequent starvation. Stocking a range on the basis of the available forage will do much to minimize the heavy losses in the Southwest.

Even in years of normal rainfall overstocking may result from any one of a number of causes. Very often stockmen are apt to overestimate the carrying capacity because of a lack of knowledge of what the range will support or because of a failure to take into consideration all of the factors involved. Where land tenure is uncer-

tain, as on the unreserved public domain, and possession of the range is largely dependent upon such heavy use that other stockmen are discouraged from attempting to use it, overstocking is willful. If prices are high stockmen are sometimes inclined to overstock their ranges in an effort to increase production. On the other hand, if low prices prevail, stockmen may attempt to carry over salable animals for a higher market, with inevitable overloading of the ranges. Insufficient water on some areas has often caused overstocking of others.

The desert ranges of the Southwest are often overgrazed because of the lack of an adequate system of control. Many bands of sheep are dependent upon these areas for winter grazing. Since there are no means by which these ranges can be held intact through the summer months, they are often used by others during this period. As a result, there is little feed left when the sheep return in the fall, and unless winter rains and other favorable climatic conditions produce an abundant growth of annual plants, overgrazing and a shortage

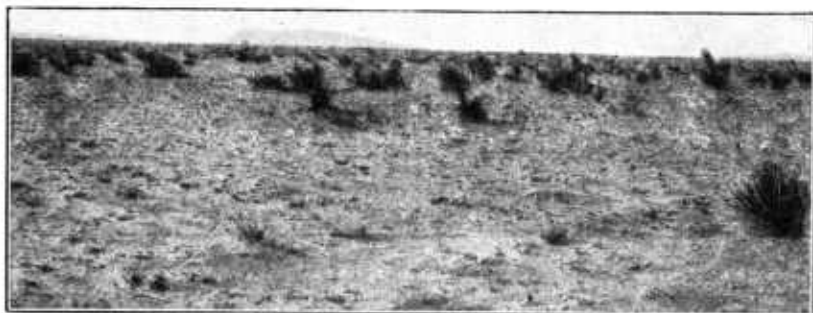


FIG. 2.—Range badly depleted by overgrazing and drought. Overgrazing must be avoided and adjustments must be made in the number of livestock to meet conditions of drought on the range

of feed will surely follow. On many of the winter ranges conditions are not favorable for this production, and dependence must be placed on the closely grazed herbage produced the preceding summer.

The continued overstocking of the range invariably results in depletion of valuable forage plants and in a reduction of the carrying capacity (fig. 2). Although this decline is usually gradual, it often occurs at a rate faster than is realized by the users. To allow excess numbers to continue grazing after range deterioration has begun endangers the entire herd. Correct determination of the carrying capacity and stocking within the limits of that capacity are essential to the permanent welfare of the industry.

RANGE SHOULD BE STOCKED CONSERVATIVELY

The rate of stocking in average years should always be conservative, even to the extent of leaving unused 10 to 15 per cent of the palatable herbage of the important range plants. It is advisable to lose the use of that amount of forage each average year in order to have this margin available to meet unforeseen climatic conditions, and to avoid the risk of bringing about a gradual deterioration of the range.

The situation on the open range of the public domain can be remedied only by such a systematic regulation of its use as will permit more secure tenure, make lighter stocking possible, and provide for the reservation of areas for critical periods by fencing or other means.

Safeguarding against possible losses that might result from carrying over of salable livestock for a higher market, or from carrying through a few more head than the range will properly support, rests wholly with the owner. It is best to be on the safe side and dispose of surplus animals even on a low market.

STEPS TO PREVENT STARVATION LOSS AMONG CATTLE

The successful continuation of cattle production in the Southwest depends upon something being done to lessen the effects of drought. Years of experience and careful study have shown that the business may be so organized that many of the undesirable features will be eliminated. The available measures which should be followed are:



FIG. 3.—Good feed on a well-managed range. An ample supply of range forage throughout the year is the first requisite if livestock losses from starvation are to be avoided

(1) Limit breeding cattle to range capacity in poor years; (2) cull the breeding herd; (3) wean calves early; (4) reserve part of range for annual critical period; (5) develop adequate watering facilities; (6) provide feed to supplement grazing; (7) give proper care and attention to the cattle.

LIMIT BREEDING CATTLE TO RANGE CAPACITY IN POOR YEARS

The first step in reducing the loss from drought is to adjust the number of animals to the carrying capacity of the range during the critical periods (fig. 3). In other words, there should be a means of providing variation in the number of cattle on the range in accordance with the amount of forage produced in various years. As the Southwest is primarily a breeding section and as breeding cows are difficult to dispose of on short notice, this variation is not possible if the range is fully stocked with this class of animals. To meet the situation on the breeding range, therefore, the number of cows in the breeding herd should be restricted to what the range will carry in poor years.

This plan will provide sufficient range for the breeding herd at all times except during very severe drought, when supplemental feed is necessary, but will, of course, result in some surplus forage

in good years. This surplus feed may often be utilized profitably by holding over or buying young steers or occasionally heifers. Such stock can be moved readily, and if sold while in good condition they usually find a fair market. The age, number, and class of such cattle to be carried will depend upon the character and amount of range pasturage not needed for the breeding cows and upon the state of the market. The success of this plan, of course, is contingent upon disposing of the surplus animals as soon as a shortage in range forage for the breeding herd is imminent, and no attempt should be made to hold the surplus cattle for a better price or for improved range conditions. It is far better to sacrifice some of the surplus than to run the risk of heavy losses taking place among the breeding animals.

CULL THE BREEDING HERD

Old cows and weaklings should be culled from the herd and disposed of in the fall of each year. When a cow on the southwestern ranges reaches 10 years of age she has past her best breeding period and her ability to rustle for feed on the range has materially diminished. Usually by that time her teeth have become worn down or some of them have been lost. If she is left on the range, there is great danger of her dying or requiring extra feed and care, particularly in a dry year. Such cows are becoming much less salable all the time. It is therefore a desirable practice to dispose of these animals and replace them with vigorous young heifers. Some cows under 10 years appear to have weaker constitutions than the average animal and are less able to rustle for themselves on the range. Whenever such animals are detected they should be sold.

WEAN CALVES EARLY

It is the general practice in the Southwest to allow calves to follow their mothers until they are weaned naturally or sold. Obviously a cow will not do so well on the range when suckling a calf as when she has only herself to provide for. Ordinarily a calf will not make much growth during the winter and spring if its mother is not in good condition; in fact, the calf is benefited if it is weaned in the fall and placed on good grass range with a small ration of cottonseed cake or other concentrated feed. If the calves are weaned at 6 to 8 months of age, fewer of the cows will require additional care or feed than would otherwise be necessary in order to avoid loss. In a feed emergency these weanling calves should be marketed immediately.

If calves are weaned at 6 to 8 months (fig. 4) and placed on good pasture, they will require three-fourths to 1 pound of cottonseed cake per day to insure fair growth. Calves weaned under 6 months of age should be fed a small ration of alfalfa, silage, or some other available feed in addition to the range pasturage and the cake or meal to insure their growth. The early weaning and supplemental feeding of calves will result in less stunting and the yearlings will have a heavier weight. This gain is usually sufficient to offset the cost of feeding. Furthermore, the cows will be in better shape to breed and will raise a larger number of calves over a period of years.

RESERVE PART OF RANGE FOR ANNUAL CRITICAL PERIOD

The heaviest losses occur when the supply of feed on the ranges is getting short. Even though the range as a whole is not overstocked, poor cattle may still be underfed. On range used the entire year, the areas near watering places are naturally the first to be used following the summer rainy season. Then, when the critical period comes on and the cattle are in their poorest condition, they are forced to seek their feed at distances remote from water. This involves the loss of much energy and time that could otherwise be devoted to grazing. Range near water should be reserved for use during this critical period.

The ideal pasture arrangement would be to divide the range into two units, one for summer grazing and the other for winter range, with provision of smaller pastures for the poorest animals. Such a system would not only provide good winter range for all of the herd but would also allow part of the range to recuperate during the



FIG. 4.—Poor cows with large calves on a southwestern range. If calves are weaned when they are 6 to 8 months of age, cows will do better on the range. Earlier weaning and supplemental feeding are necessary in dry periods

growing season each year. Where part of the range is suitable for summer grazing only, such a division is needed to secure the best use of the feed.

Another advantage of the division of the summer and winter range is the opportunity afforded the stockman in the middle of the grazing year to check up the amount of feed available until the next growing season. If the summer-fall range becomes exhausted too early, it is usually safe to assume that the winter-spring range is deficient, and adjustments may be made accordingly. It is far more difficult to estimate the quantity of forage remaining at midyear, if the stock use the same range throughout the year.

Much of the grazing land in the Southwest is admirably suited to this division into summer and winter ranges. The higher mountain areas are suitable mainly for summer use, because of the climatic conditions. On the lower mountain slopes are found nutritious grasses which cure on the stalk, and a large amount of palatable browse which provides forage during the winter and spring.

Two or three main classes of forage plants occur on much of the lower semidesert range. These include galleta-grass, tobosa-grass,

grama-grasses, mesquite-grass,¹ and various species of browse. The galleta-grass and tobosa-grass are best suited for summer grazing, as they become dry and less palatable after the growing season. The grama-grasses are equally valuable for both summer and winter use. The browse is best adapted to winter and spring grazing. The combination of large areas of the summer grasses and of grama-grasses and browse on the same range unit lends itself very well to the division of summer and winter ranges. Where the forage on a range unit is all grama-grass or similar grasses, division is, of course, equally practicable.

DEVELOP ADEQUATE WATERING FACILITIES

An adequate supply of good clean water (fig. 5) within easy reach of the range at all times is essential to the welfare of livestock. Cattle in poor condition are, of course, less able to travel long distances to water. Watering places should not be more than 5 miles apart on comparatively level range and $1\frac{1}{2}$ to 3 miles on rolling or rough range. Shorter distances give better results, especially with poor

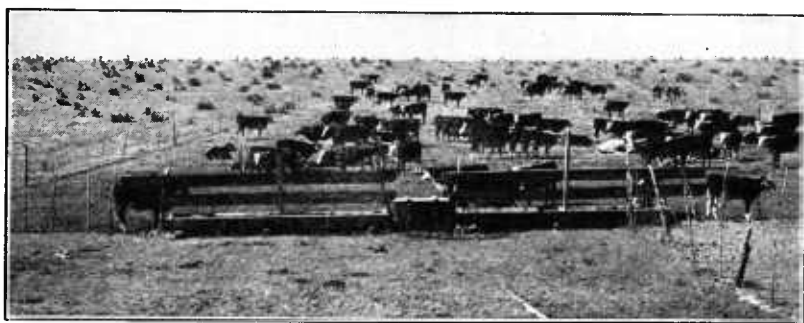


FIG. 5.—An adequately equipped watering trough at a well in the Southwest. Properly spaced and well-equipped watering places are a profitable investment. Poor cattle are not able to travel more than $2\frac{1}{2}$ miles to water on level range and $\frac{1}{2}$ to $1\frac{1}{2}$ miles on rough or rolling country, without detriment to the stock and injury to the range.

cattle. Watering places should be so well equipped that there will be no crowding of the animals around them or waiting for an opportunity to drink. Otherwise, the weaker animals are liable to be injured or prevented from drinking for several hours each time they come in for water. Starving for water for short periods is much more injurious than starving for feed. Heavy losses have occurred even when livestock were in good condition, because pumping equipment has broken down or been neglected. A stored supply of water should be available to meet emergencies.

In many localities tanks or reservoirs to catch run-off from rainfall (fig. 6) are used for watering livestock. Such places should be carefully watched, and cattle moved to other waters when the supply becomes exhausted or gets so low that weakened animals may "bog down" in the soft mud.

¹ Galleta-grass (*Hilaria jamesii*); tobosa-grass (*H. multiflora*); grama-grasses (*Bouteloua gracilis*, *B. eriopoda*, *B. hirsuta*, *B. curtipendula*, *B. rothrockii*); mesquite-grass (*Hilaria belangeri*).

Approaches to drinking troughs should be kept dry and in good condition. If a weak cow slips down after drinking, she may be unable to get to her feet again, and die on the spot unless some one is at hand to help her. Troughs should always be so covered or protected as to prevent animals from falling into them or trying to step across them.

PROVIDE FEED TO SUPPLEMENT GRAZING

Even the greatest care in maintaining a good supply of range forage and water, particularly on the poorer ranges of the Southwest, will not avert all losses from starvation. The range is none too good at best during the winter and dry spring, and a few of the less thrifty cows, usually those with suckling calves or those heavy with calf, are liable to die if left to shift for themselves on the range. Moreover, there may be times when, as a result of unforeseen circumstances, the reservation of range or the taking of certain other measures may be insufficient to keep stock from becoming poor. In



FIG. 6.—A tank for catching flood water. These tanks are an important means of furnishing water for stock in the Southwest

times of prolonged drought the supply of range forage may approach depletion or become exhausted. The use of supplemental feeds, so far as it is economical, will assist in carrying the stock over these crises. The principal feeds available for this purpose in the Southwest are cottonseed products, irrigated and dry-land forage crops, and several native plants that may be prepared for stock feed.

Availability and cost of supplemental feeds, particularly cottonseed products and farm crops, have been determining factors in their use. Much depends upon the foresight of the stockman himself. When the critical period has arrived it may be difficult to obtain feed, or too late to get it to the cattle in time, or the cost may be excessive. The supply of crops is limited and may not be available in the quantity needed on short notice. Not uncommonly the fall price of cottonseed cake has doubled or trebled by spring when the demand is greatest. Cattlemen will usually profit by storing feeds early in the season or during good years when prices are always lower, as near as possible to the range where the cattle can be

fed conveniently. The interest on money thus tied up will, over a period of years, be far exceeded by the saving in the cost and in the added security and ability to meet emergencies promptly.

COTTONSEED PRODUCTS

Cottonseed products, particularly cottonseed cake or meal (fig. 7), when fed in small quantities as a supplement to range grazing will keep cattle from reaching a dangerous condition. The range forage is dry and usually low in nutritive value during winter, and the addition of the concentrate will make a better balanced ration. While cattle will subsist on this rich food alone for a considerable period, the best results can be had only when it is used as a supplement. It is well adapted for supplemental feeding on the range, especially if feed must be hauled a long distance. A supply sufficient for a large number of animals can be moved more cheaply than hay or other more bulky materials, and its distribution among cattle is a comparatively simple matter.



FIG. 7.—Feeding cattle cottonseed cake in troughs. A daily ration of three-fourths of a pound of cottonseed cake, together with dry range forage, forms an economical basis for maintaining breeding cows during critical periods. A larger number of calves and better growth will result.

It is usually advisable to feed the cake or meal that has a protein content of 40 per cent or more, especially if the freight rate or the cost of haul from the railroad is high. Feed lower in protein serves very well, however, if the haul is short, but the amount fed should be increased to compensate for the deficiency in protein.

Unmilled cottonseed has also been fed with good results. The seed is a little cheaper than the cake or meal, but there is usually such a demand for the oil from the seed that the supply of unmilled seed for feeding purposes is limited. Cottonseed hulls are a valuable roughage, but their use is limited largely to the vicinity of the mills.

Quantity to feed.—The quantity to be fed will depend upon the condition of the animals, but usually three-fourths to a pound of cake or meal a day for each animal, with plenty of dry range forage, will make a maintenance ration. Thus a hundred pounds of cake per head for the average number of stock to be fed is adequate for a hundred-day feeding period, and this amount is ordinarily sufficient to provide for the usual critical period of the spring in the Southwest.

Placing the feed in troughs is generally the most satisfactory method of feeding; but cottonseed cake is eaten very well when it is

scattered on smooth, hard ground, the surface of which is free of sand, gravel, or small rocks. Cottonseed meal, however, can not be used with satisfaction on the ground. If high winds occur a considerable amount of the meal may be wasted, even when troughs are used. For this reason many stockmen prefer the crushed cake, which comes in small lumps.

Cost of feeding.—The cost of feeding cottonseed products varies with the market price of feed, distance from the mill, and length of haul from the railroad. Under normal conditions the higher grade of cake can usually be fed for \$40 to \$60 per ton. This amounts to \$2 to \$3 a head for the number of animals fed for a 100-day period on the basis of a pound a day for each head. When the smaller losses and larger calf crop are considered, that is a nominal cost per head.

IRRIGATED FORAGE CROPS

The use of irrigated forage crops as emergency feed for range cattle is limited largely to those animals located within a short distance of the irrigated areas. The practicability of using these feeds for this purpose depends very largely upon the cost of feeding and upon their availability at the critical period. Ordinarily there is such a demand in the Southwest for products of this kind for other purposes that it is uneconomical to buy them for range cattle except to a limited extent and for short periods of emergency or for high-grade animals. Alfalfa hay and silage provide the principal harvested forage; alfalfa and other stubble fields and winter-wheat fields supply much pasturage.

With other roughage available, 5 pounds of alfalfa a day, with a half pound of cottonseed cake, will keep a mature cow alive under emergency conditions. However, this ration is not sufficient for a pregnant cow if the calf is to be saved. Fifteen pounds daily of alfalfa, supplemented by 1 pound of cottonseed cake, will keep a mature cow in very fair condition during emergency periods. If sufficient alfalfa is used no supplement is needed.

Plants of the sorghum group produce heavy yields in comparatively short periods under irrigation. Where the growing season is long they may be grown on a piece of land from which an earlier crop has already been harvested the same year. A grown cow will require 17 to 20 pounds of silage with 1 pound of cottonseed cake per day for a maintenance ration. The cottonseed cake or meal may be eliminated if a larger amount of silage is fed.

The stockman who owns some irrigated land in connection with his range is in the best position to feed irrigated crops, because he is able to raise some feed each year and store it for a future emergency. There is also the added advantage of having some stubble fields for pasturage to tide over a few head of poor cattle.

Climatic conditions in the Southwest are such that alfalfa continues to grow for a considerable period after the last cutting has been made. If grazing is not too heavy it does not injure the alfalfa, and considerable feed may often be obtained in this way during the winter. The period of use will vary with the locality and the severity of the winter. Alfalfa fields may usually be rented for such grazing at a reasonable cost, though in some parts the rental has been high during certain seasons.

The area of winter wheat planted on irrigation projects in the Southwest is not large, but where it has been planted the fields will furnish considerable grazing during the fall and winter months.

DRY-LAND FORAGE CROPS

In parts of the Southwest where the average annual rainfall is 15 inches or more and soil conditions favorable, dry-land forage crops may be raised with a fair degree of success. Such crops are more uncertain in the parts where the average annual rainfall is less than 15 inches. At that, however, in the wetter years there is often sufficient moisture to raise a fodder crop in the drier parts, especially on areas that are flooded by run-off from near-by hills. Even under the more favorable dry-farming conditions, crops can not be expected every year, as approximately three to five years out of every ten are too dry for crop production. However, if a crop is raised every good year and stored for use in times of emergency, sufficient feed will ordinarily be available to carry stock through critical periods. The crop failure in drought years would, of course, increase the cost of providing the feed. However, as this feed is raised for emergency purposes, its value should not be reckoned in terms of current market prices, but should be considered as insurance against losses.

Plants of the sorghum group, particularly the kafirs, are best adapted to dry-land farming in the Southwest. The State experiment stations have done a great deal of work with these crops and are in a position to furnish information about the ones best adapted to any particular locality, the methods of planting, and other related matters.

SILAGE

Fodder crops may be kept for future use if harvested and stored dry or placed in a silo. Storing in a silo probably offers the best possibilities, as it preserves the forage values better than dry storage. Pit or underground trench silos have been found to give better satisfaction on the range in the Southwest than silos built above the ground. The soil in most localities is suitable for construction of this character, underground construction is cheaper, and the cost of maintenance is usually very low as compared with that of a silo built above the ground, particularly if lumber or metal is used. Wooden silos will not long withstand the dry atmosphere or heavy winds characteristic of the region, and the metal silos also are subject to damage by wind.

The ditch or trench silo offers an economical method of storing silage. The feed is placed in a trench or ditch several feet wide and several feet deep, dug with a team and scraper. The silage is then covered with earth to a depth of $1\frac{1}{2}$ or 2 feet. When stored in this way silage will keep for several years without deterioration.

NATIVE PLANTS

There are a number of range plants in the Southwest which, because of their spiny growth, toughness, or inaccessibility, are not in their native state available for stock. Chief among these are soapweed (*Yucca elata* and other species), Spanish dagger (*Yucca*

macrocarpa), sotol (*Dasylirion wheeleri* and *D. texanum*), sacahuista (*Nolina* spp.), beargrass, also called soapweed (*Yucca glauca*), prickly pear and cholla (*Opuntia* spp.). Wherever found these plants may be made into feed by various methods and used to advantage during periods of emergency. However, because of their slow growth and the cost of making them into feed, their use at other times is less practicable and too expensive.

Soapweed.—Soapweed grows somewhat abundantly on the lower ranges in western Texas, southern New Mexico, and southwestern Arizona. Its use as emergency feed for cattle (fig. 8) has been well developed in recent years, and it has been fed for periods of six months or longer with satisfactory results. It is low in nutritive value, however, and a small quantity of cottonseed cake or meal should be fed in connection with it.

Soapweed is sometimes chopped and fed immediately after cutting, and sometimes it is stored as silage. In both forms it has ap-



FIG. 8.—Feeding poor cattle ground-up soapweed in troughs; 20 to 25 pounds of chopped soapweed with 1 to 1½ pounds of cottonseed meal a day will maintain a grown cow and may bring about a slight gain in weight

proximately the same feed value. There is no advantage in converting it into silage except that it is possible to have the feed ready when needed without extensive labor operations at the time. The making of it into feed requires special machinery and entails considerable labor. If this work is done at the time of feeding, it is usually necessary to concentrate a large number of cattle at one place or to duplicate the machinery and labor organization. If the feed is prepared beforehand and stored in a silo, the work can be done at slack time with one set of equipment and often at a smaller cost. With several silos located at vantage points on the range, it is possible for a few men to feed a large number of animals at each place successfully as occasion demands. Furthermore, no risk is run of breaking down the equipment or of some other difficulty arising that might cause a shortage in feed.

For feeding,² the plant is cut with an ax on the range, hauled to the site of the feeding operations, and run through a machine that cuts or shreds the plant into small pieces, after which it is placed

² For a full discussion of the feeding of soapweed, see "Chopped Soapweed as Emergency Feed for Cattle on Southwestern Ranges," by C. L. Forsling, U. S. Dept. of Agri., Bul. 745, January, 1919.

in troughs in the feed lot. Because the heavy stalk of the plant is peculiarly tough, a special machine is necessary. Several types of machines have been perfected and are available on the market in the Southwest. It is best to remove the dead, dry material from the stems of the plants before grinding. This may be done by burning either on the range before cutting or after the plants have been hauled to the machine. Unless there is danger of the fire spreading, it is most practical to burn the dead material on the range. One man with a torch is able to burn all that four men can cut and haul in a day. Burning the waste after the plants have been brought in means hauling a lot of waste material and requires an extra handling. Furthermore, unless the plants are very well scattered, the heat from the burning becomes so intense that much valuable material is lost.

Twenty to twenty-five pounds of chopped soapweed with 1 to 1½ pounds of cottonseed meal per day will maintain a poor cow and may bring about a slight gain in weight. The cost of converting and feeding soapweed varies from \$2.25 to \$3.75 per ton, depending upon the cost of labor and the length of haul. With cottonseed meal at \$40 per ton, it will cost \$1.45 to \$1.80 per month to maintain a cow.

There is very little danger of loss of cattle from feeding soapweed even for long periods if it is properly done. Occasionally an animal may choke to death on a large piece that passed through the machine. There is possibility of loss from bloat if a hungry cow gets all she can eat at the first few feedings, but this danger may be averted by feeding a small ration for two or three days. Because of its slow growth and the consequent length of time required for replacement of a stand, as well as on account of its low forage value, the use of soapweed should be confined mostly to meeting emergencies.

Spanish dagger, beargrass, and sacahuista.—Spanish dagger may be prepared and fed in much the same way as soapweed. However, it is not so abundant and is somewhat more difficult to handle because of its great toughness. It is found in practically the same region as soapweed, and where it grows in sufficient abundance it may be used to advantage as an emergency feed.

Beargrass, or low soapweed, is found north of the range of the tall soapweed. Although the stem is short the green leaves are valuable for feed, and if found in sufficient abundance this plant may be prepared in much the same way as the larger species. In its natural state the harshness of the leaves prevents its being grazed extensively. However, running it through a machine tears the leaves apart so that they may be readily eaten.

Sacahuista, also called beargrass, is another plant that resembles the true beargrass of the Southwest in its growth characteristics. Its occurrence is more limited than that of the plants already mentioned, but where it is found it has value as an emergency feed. Its preparation, however, does not require so heavy a machine.

Sotol.—Sotol is another semidesert plant closely related to the soapweed and beargrass that grow in parts of the Southwest. It has a food value higher, perhaps, than that of the other species,

but it is very much slower of replacement when it has once been cut. It occupies rocky soils on rough sites and therefore is not so accessible as the other plants.

The low, thick, barrel-like trunks or stems of sotol furnish the feed, and the leaves are practically worthless. Unlike soapweed, it can be prepared by chopping it to pieces on the range with an ax. It has been used to a considerable extent in parts of Texas for fattening stock. Its use for feed is limited as compared with the other plants, because of its scarcity. Furthermore, many areas that once supported good stands now have very little left. Wherever the plant is still found it may be used for emergency feed, but its use should be limited strictly to that purpose in order that a supply of it may be available when it is most needed.

Prickly pear and cholla.—Prickly pear has been used in Texas and other parts of the Southwest for a great many years both as emer-

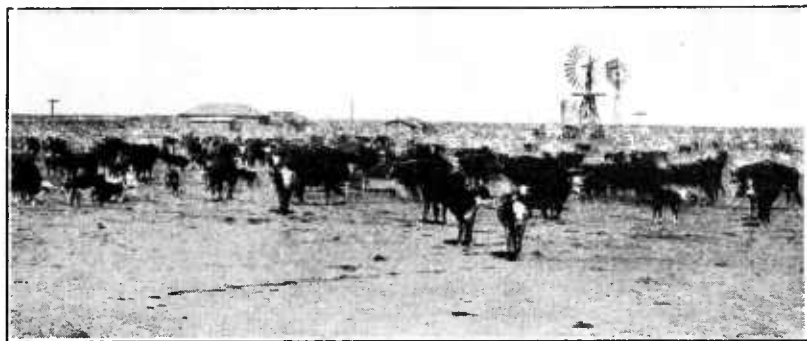


Fig. 9.—Congestion of poor cattle at a feeding place. It is the better practice to begin early the measures calculated to prevent starvation rather than to wait until a large percentage of the animals reach a critical condition. Otherwise the available feeding facilities may be overtaxed, more feed will be required, and it can not be used to its highest efficiency

gency feed and for fattening livestock. Cholla also has been used as an emergency feed. Both of these plants are very spiny in their natural state but may be prepared by burning off the spines with a torch or by running the plants through a cutting machine which renders the spines practically harmless. The simplest method is to burn the spines on the range, the stock being allowed to follow and eat the plant. Special torches have been developed and are procurable on the market. If there is a large supply of the plants, one man equipped with a burner can prepare the feed for 200 to 400 head of cattle in a day. The best results may be had with prickly pear and cholla if a small ration of cottonseed meal or cake is fed in conjunction with them.

There is also a spineless variety of prickly pear that may be readily propagated in parts of the Southwest. As the absence of spines renders the plant available for grazing at all times, protection should be given, except when the feed is needed, to any area on which it is desired to reserve a supply. This protection must be against rabbits and other rodents as well as against cattle.

GIVE PROPER CARE AND ATTENTION TO THE CATTLE

The success of the measures calculated to prevent or minimize losses depends to a great extent upon the manner in which the stock are handled and upon the timely undertaking of the necessary safeguards. Unwarranted rounding up, rough treatment, and constant moving or disturbing of the herd are detrimental to weak animals and should be avoided. Some handling, of course, is necessary in getting animals to the feed lot and in grouping them for feeding (fig. 9), but it should be done slowly and carefully.

Range cattle are more excitable when handled than are farm cattle and may be slow in learning to take feed. This has led some stockmen to the opinion that good results are not possible in feeding range stock. There may be an occasional cow that can not be made to eat at all; but, as a general thing, even the most timid



FIG. 10.—A cow that got "down" because of lack of early attention. Attempting to save animals so weak that they are unable to get to their feet is an expensive undertaking. A prudent stockman will handle his business so as to avoid such a situation if possible.

animal will learn to eat and become accustomed to the close handling and presence of people around a feed lot.

Attention should be paid to the stock on the range at all times. Their condition should be noted, particularly at the approach of the critical period, to determine the need for special care or feeding. The poor cattle should be placed on better pasturage or on feed. This may be accomplished by working the herd at watering places, or a rider may go over the range gathering up the poor cows and moving them carefully toward a reserve pasture or feeding ground without extra rounding up.

Feeding weak cows along with the stronger animals should always be avoided, for the weaker animals are driven back and do not get their share of the feed. Separate lots or pastures should be maintained so that animals in different degrees of emaciation may be placed where they will receive feed and attention (fig. 10) in accordance with their condition. The cattle in each lot should be carefully watched. Animals that have improved should be moved to the next lot up the scale, and cows that are not holding up should be moved to the next lot down the scale. This will insure those of equal strength being in each lot at all times, and the greatest benefit will be derived from the feed.

On the Jornada Range Reserve in southern New Mexico in 1918, during a drought, no less than five feed lots were maintained in handling the cattle. In one lot were placed the poorest animals, and they were fed all the soapweed they would eat with $2\frac{1}{2}$ to 3 pounds of cottonseed meal per day. Another group consisted of cows receiving all the soapweed they would eat, with 2 pounds of cottonseed meal per day. A third group received 20 pounds of soapweed and 1 pound of cottonseed meal per day. A fourth was fed cottonseed cake along with the range grass. A fifth was made up of dry and young cows that were able to subsist on range forage alone. All the various groups were carefully watched, and there was shifting from one group to another as conditions warranted. As a result losses were kept down without undue use of feed.



FIG. 11.—Ewes and lambs on summer range. Sheep prosper on the luxuriant forage on the high mountains of the Southwest during the summer months

STEPS TO PREVENT STARVATION LOSS AMONG SHEEP

The sheep business in the Southwest is subject to practically the same vicissitudes as the cattle business, but probably to a somewhat less degree of severity. Sheep are under better control and may be more readily shifted to meet changing range conditions, the increase in numbers is more rapid, and the returns from the business are earlier. This places the sheepman in a position to sell part of his stock when drought becomes serious and to build up the flock after the critical period has been passed. He may also go to considerable expense in providing reserve ranges, in feeding, or in moving his sheep to other range (fig. 11) in order to meet the decrease in carrying capacity of the range in case of emergency. Most of the sheep losses have been due to the neglect of one or more of these safeguards.

As a rule, the sheep-growers' losses are heaviest about lambing time. A large percentage of the sheep are wintered on the semi-desert range, where forage varies widely even under average conditions. Most of the ewes are bred to lamb early in the spring, in order that the lambs may be ready for the early fall market. This is the period when range feed (fig. 12) is most uncertain; and, if there is a lack of early rain or warm weather to bring on the spring growth, losses may be heavy. Under such conditions many lambs are stillborn and some are too weak to survive, or because of inadequate

milk supply starve to death shortly after birth. Weak ewes will frequently refuse to own their lambs. On higher lambing grounds many lambs are killed during late snows or cold rains as a result of exposure and decrease in milk flow. Many of the lambs that survive may be stunted and fail to attain average weight by the time of sale. High mortality is not uncommon among the ewes, particularly the older animals. Although it may be short, this critical season is often so severe that practically an entire lamb crop may be wiped out and many of the breeding ewes may be lost.

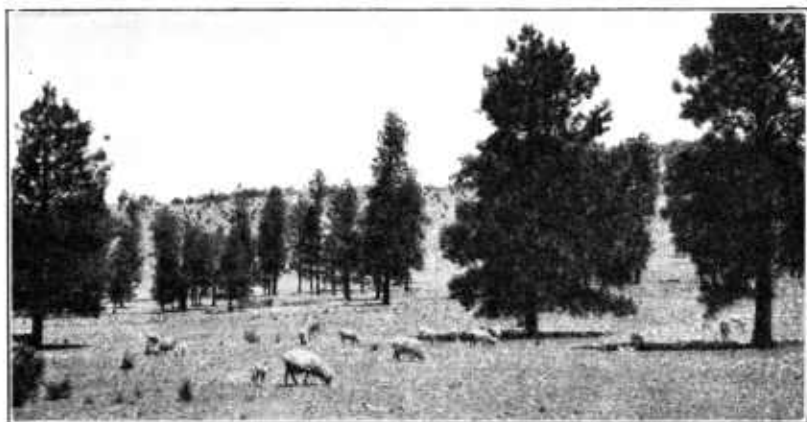


FIG. 12.—Ewes with young lambs on closely grazed range. Lambing time is the critical period of the year in the range sheep business in the Southwest. Losses are liable to occur if the range is closely grazed and spring rains are late in bringing on fresh green herbage.

RESERVE PART OF RANGE FOR LAMBING

Good forage is needed during the lambing period. Selecting suitable areas of range (fig. 13) and reserving them for use during lambing will go a long way in reducing losses during the critical spring period. When lambing takes place on range that has been grazed all winter there is only scant feed left. Ewes with young lambs are not able to cover much ground for feed, and losses are bound to result if the forage is short. The reserve pastures will insure much better grazing. Such areas should have a grazing capacity sufficient to carry the ewes and lambs over the dangerous months. These pastures should be located where early green feed may most confidently be expected and where protection against storms is afforded. Adequate watering facilities should be provided. If these areas are fenced to prevent their being grazed the rest of the year, and to provide against predatory animals, the labor cost of handling the sheep during lambing time will be greatly reduced. As lambing pastures are used at a season when grazing is most injurious to the forage plants, it is important that grazing be prohibited the rest of the year to insure the largest possible forage supply during lambing. On the higher range, lambing sheds should be available in case severe storms occur (fig. 14).

Many of the sheep in New Mexico and Arizona are wintered on the open range of the public domain, where reserving of areas for use in the critical period of the year is impracticable with the present lack of regulation. Stockmen will therefore profit by purchasing private or State land at a reasonable price, or by leasing an amount sufficient to provide for the lambing period.

PROVIDE SUPPLEMENTAL FEED WHEN NECESSARY

The use of reserved lambing pastures is often sufficient to prevent lambing losses and insure an average lamb crop. Close personal attention to every lambing ewe is, however, absolutely necessary to success. In average years it is advisable to provide some feed in addition to the reserved range forage. In years below the average, extensive feeding or removal of sheep to other range may be necessary.



FIG. 13.—Young lambs with their mothers on the lambing range. Plenty of range forage is necessary if a large proportion of the lambs is to be saved. This forage may be provided by reserving an area of range for use only at lambing time. Such an area should have abundant feed, plenty of water, and natural protection against storms

If ewes have been bred to lamb about the time the first green feed usually comes in on the range, losses are liable to be heavy in the event of the spring rains being delayed even for a few weeks. It is too late to move the sheep after the lambing has begun, and it may not be possible economically to obtain feed at once. If, therefore, several months in advance, the sheepman has stored on the lambing range a quantity of feed sufficient to meet reasonable requirements, he has insured himself in the event of an emergency. Furthermore, he has probably had the advantage of buying in a lower market. Even if the feed is not needed that season, it will keep over until another year without much deterioration. In the meantime the herd will be safeguarded against severe loss from starvation.

COTTONSEED PRODUCTS AND GRAIN

Cottonseed cake or meal or other similar concentrated feed is valuable under most conditions for supplementing range feed for

sheep. When some roughage is available on the range, one-fourth pound per head per day of the concentrated feed will maintain the ewes in condition to furnish a good supply of milk and will insure a high percentage of survival among lambs. Corn, oats, or other grain may be used as supplemental feed with equal success, but in the Southwest it is usually more convenient to obtain the cottonseed products.

IRRIGATED PASTURES AND FORAGE CROPS

When irrigated pastures and forage crops are available they are important supplements to range forage for sheep (fig. 15). The flocks may be conveniently moved to the feed, and the additional cost of feeding during lambing time, particularly if range feed is short, will be more than offset by the survival of a larger number of lambs. Many sheepmen are taking their bands to the irrigated valleys for lambing rather than accept the risk involved in leaving



FIG. 14.—Lambing pens with sheds in central New Mexico. As severe storms may occur during lambing, it is a wise plan to provide sheds for sheltering the ewes and lambs

them on the range. In addition to there being an increase in the number of lambs "marked up," the ewes may be bred so that early-maturing lambs will be produced. Dry-land forage crops also may be used advantageously as supplemental feed for sheep.

NATIVE PLANTS

Soapweed, sotol, and prickly pear have been fed to sheep successfully, and wherever available they may be used to carry the animals over critical periods. Practically the same methods may be used in preparing these feeds for sheep as for cattle. The best success will be had if a small amount of cottonseed products is fed in addition.

CULL OLD EWES AND KEEP DOWN LOSS

Ewes should not be kept in the range bands after they are 5 or 6 years of age. Animals that have reached that age are less able to rustle forage than are younger sheep. Furthermore, if such animals are held over, they may not be in condition to mother lambs or

survive a critical period. The condition of the teeth usually determines whether or not ewes will do well on range feed. "Gunners," or animals with few or irregular teeth, are of doubtful value on the range and should be disposed of. The best time for culling is the fall, when sheep are in the best condition.

EARLY PLANNING AND ATTENTION NECESSARY

Success in keeping down livestock losses and reducing the cost of feeding depends very largely upon early attention. The recurrence of drought in the Southwest is so well established that provisions to meet it should be recognized in the livestock industry. The old adage that "a stitch in time saves nine" was never more applicable than in handling livestock. Good results can not be expected if they are allowed to remain too long on failing range before protective measures are carried out. If action is delayed until the danger point is reached, extensive feeding will be necessary and the facilities for handling the stock may be overtaxed. It is usually



FIG. 15.—A band of ewes and lambs grazing on an irrigated field. Some sheepmen find it profitable to arrange for the lambing to take place in the irrigated valleys, where there is plenty of feed. In this way lambs may be produced for the early market.

less expensive to maintain an animal in fair condition at all times than to bring about recovery after a severe setback.

Proper stocking, reserving part of the range, making adjustments in the classes of livestock retained, and providing for emergency feed are safeguards that can not ordinarily be arranged for after the critical period has arrived. These preparations require foresight and planning far in advance of the drought, and the uncertainty about when the critical time may come makes it advisable for the livestock raiser to be prepared at all times. The practice of running large herds to which suitable care can not be given, especially in times of emergency, should give place to the plan of carrying slightly smaller herds of better quality, which can be adequately fed and cared for during emergency periods. The cost of these safeguards may cut into the profits of the business in the good years; but the losses will be decreased, proportionately more calves and lambs will be produced, the raising of higher grade animals will be encouraged, and better financial credit will result. In short, this foresight would mean more efficient production, with the ill effects of adverse cli-

matic conditions largely eliminated, and the livestock business placed on a more stable and a more profitable basis.

SUMMARY

Frequent droughts constitute the chief menace to the livestock industry in the Southwest. Careful management, with foresight and planning in good years, is essential to meet these emergencies and place the industry on a more stable basis.

Overstocking has been one of the main factors in losses from starvation. In average years the range should be so stocked that 10 to 15 per cent of the palatable herbage of the important range plants is left unused. This will safeguard the range and allow some leeway in years a little below the average.

The breeding herd of cattle should be limited to the number the range forage can support in the "lean" rather than in the "fat" years. Any excess forage in good years may be used by surplus livestock which can be disposed of readily in time of drought.

The loss during the critical spring period may be offset to a large extent by reserving some winter range for use by poor cattle during this period. The ideal arrangement would be a division of the range into summer and winter grazing areas.

Breeding cows will do better on the range if calves are weaned in the fall at 6 to 8 months of age instead of being allowed to follow the cows all winter.

Poor animals should not be required to travel long distances to water. Watering places for cattle should not be over 5 miles apart on comparatively level range or more than 1½ to 3 miles apart on rough range.

Supplemental feeding will assist materially in keeping down the loss. Cottonseed products, irrigated-land and dry-land forage crops, and native range plants that may be specially prepared are the principal feeds available. Dry-land forage crops may be raised in good years on favorable areas in the Southwest, and these may be harvested and stored for use during critical times.

Careful handling of the cattle, as well as segregating the weak animals and feeding them according to their needs, will prove advantageous.

Sheep are more readily handled than cattle, returns from the business are quicker, and there is usually a better market for this class of livestock. The number of sheep, therefore, can be adjusted more readily to a change in range conditions in time of drought than is the case with cattle.

The heaviest losses among sheep usually occur at lambing time. The reservation of lambing pastures and the supplemental feeding of cottonseed products, grain, irrigated-land and dry-land forage crops, and native range plants will control these losses to a great extent.

Success in safeguarding against losses depends largely upon preparedness to meet the situation and the timely taking of necessary action. The increased cost of the protective measures advised will be more than offset by the larger returns from a business thus made more stable and profitable.